

Human-Nutrition

08/28/2025

exams will be open from tues to sat on the week they are due, get 2 attempts on the final

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## intuitive eating: finding moderation with food
### why diet mentality doesn't work
- externally motivating instead of intrinsically motivating
- ppl tend to make drastic changes in their food intake and lifestyle, which makes it hard to adjust to
- seen as temporary, strict changes that are not meant to be sustainable
- focuses on taking away instead of adding to
- label foods as 'good' or 'bad'
- don't get to the root of the problem (ex: sedentary lifestyle, causes of overeating (habits, trauma), underlying health issues such as hormone imbalances)
- diets are difficult to take on the road, or to upkeep in busy lifestyle
- focuses on weight loss, not wellness. this can lead to more weight being gained than was lost during the diet
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### intuitive eating focuses on additions rather than subtractions
- adding eating times (optimal every 3-4 hours)
    even if it's a small amount of food, this can help people feel properly fueled
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this can also depend on the person, and how much they eat at once. some people feel better with more small meals, and some would rather have a few larger ones

- variety helps the food feel interesting and exciting
 - meals = 3 food groups
 - snacks = 2 food groups
- fruits and veggies tend to be underrepresented in a lot of american's diets
- water! chronic dehydration is A Thing
- physical activity, 1 hr for every 8 hours sedentary

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## understanding hunger and fullness
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0	: empty
1.5	: ravenous
3	: weak
4	: pangs
5	: neutral
6.5	: satisfied
8	: full
9	: stuffed
10	: sick

goal is to stay between 3-7, and going to one of the extremes can cause you to

swing to the other extreme

strategies to notice fullness

- the food stops tasting as good, not getting enjoyment from it, texture starts to bother you
- take mini breaks when eating
- learn from history (if you get a serving of food and feel too full after eating it, make a mental note that next time you would prefer a smaller serving)

emotional eating

ask yourself:

- am I hungry?
- how am I feeling?
- what do I need?

it's not that we can never eat when we aren't hungry, but it shouldn't be a frequent thing or get to the point of impacting our feelings of wellness

top reasons for emotional eating: boredom, stress, lonely, tired, want a reward, habits/environmental queues

power snacks: ideally want to have a protein (lasting energy) and a carb (quick energy)

key note: food does not have a moral value! there are not 'good' vs 'bad' foods, and you are not good or bad for eating foods. All foods can have a place in a balanced diet, but some are 'sometimes' foods that do not provide as much value to you

body acceptance

negative filtering: focusing on a negative aspect to the point that it drowns out all other things

tip: leave with one good thing (before starting your day, or each time you think about your body, end with a positive thing)

focus on what your body can do

09/02/2025 ch 1

- nutrients are life sustaining substances found in food necessary for growth, maintenance, and repair of body cells
- nutrition is the scientific study of nutrients and how the body uses them

why study nutrition?

- poor dietary practices are associated with obesity and type II diabetes
- healthy diets support longer, healthier lives

characteristics of nutrients

the nutrients:

- vitamins
- minerals
- fat
- protein
- carbohydrates
- water

nutrients are sources of elements (substance that cannot be separated into simpler substances by ordinary chemical or physical means) needed by the body

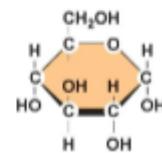
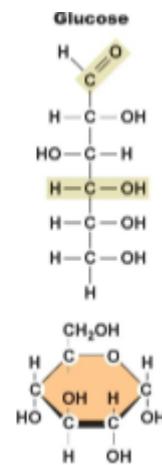
TABLE 1.2 Elements in Nutrients

Nutrient Class	Elements*
Carbohydrates	Carbon, hydrogen, and oxygen
Lipids	Carbon, hydrogen, and oxygen; phosphorus (phospholipids); nitrogen (certain phospholipids)
Proteins	Carbon, hydrogen, oxygen, nitrogen Sulfur (methionine and cysteine)
Vitamins	Carbon, hydrogen, oxygen Nitrogen, sulfur, phosphorus, cobalt
Minerals	Sodium, magnesium, potassium, calcium, chromium, manganese, iron, cobalt, copper, zinc, molybdenum, phosphorus, sulfur, chlorine, selenium, iodine, fluorine
Water	Hydrogen, oxygen

ways to classify nutrients:

- organic (contains carbon)
- non essential (nutrients synthesized in the body from raw materials from food)
- essential (must come from food)
- energy yielding

	CHO	Lipids	PRO	Vitamins	Minerals	Water
Organic	x	x	x	x		
Energy Yielding	X	X	X			
Macro	X	X	X			
Micro				X	X	X



six classes of nutrients

vitamins: organic, found in produce and grains

minerals: major (large amounts, such as calcium in teeth, rec 1200 mg/day) or trace (smaller amounts, such as iron in red blood cells, rec 8-30 mg/day)

fat: organic, energy yielding, helps the body insulate and protect itself

protein: organic, can be from plant or animal sources, important role in muscle building and maintenance, hormones are also protein

carbs: organic, energy yielding, preferred fuel source for brain and muscles, found in fruit/grains/dairy products

water: found in all drinks and most foods, important for cooling and cushioning in the body, helps remove waste from the body

phytochemicals

- substances in plants that are not nutrients but may have health benefits
 - caffeine
 - beta-carotene
 - organosulfides
 - nicotine (not beneficial)

deficiency

- deficiency disease occurs when the body lacks a nutrient
- signs: observable physical changes (such as bleeding gums for vitamin c deficiency)
- symptoms: subjective complaints of ill health (tiredness for iron deficiency)

calories vs Calories

a calorie is the amount of heat needed to raise the temp of 1mL of water 1 degree C - this is a very small unit of measurement, so food energy is measured in 1000 calorie units

a kilocalorie (or Calorie) is the heat energy needed to raise 1L of water 1 degree C

example: apple

1 apple = 40,000 calories = 40 kcals = 40 Calories

energy yielded from nutrients

1g carbs = 4 kcals

1g protein = 4 kcals

1g fat = 9 kcals

1g alcohol = 7 kcals

1g lipids = 9 kcals

Lifestyle factors that impact health

Chronic Disease

Chronic diseases are long term conditions that usually take years to develop and have complex causes.

- heart disease
- diabetes
- cancer

Risk Factors

Risk factors are personal characteristics that increase a person's chances of developing a chronic disease.

- family history
- unsafe environmental conditions
- psychological factors
 - emotional stress
- social determinants of health
 - access to good food and healthcare
- advanced age
- unhealthy lifestyle

General rule: for every 8 hours of sedentary time, do 1 hour (or more) of physical activity

being sedentary for more than 8 hours a day without physical activity has a mortality risk comparable to smoking 😞

'healthy people 2030' project

This project is a list of goals (updated every 10 years) issued by the department of health and human services to promote health and prevent disease.

main takeaways for 2030:

- limit food and beverages high in added sugars, saturated fat, and sodium
- increase intake of fruit, vegetables, whole grains, calcium, potassium, vitamin D

factors that influence eating habits

- what was the last thing you ate today?
 - WHERE were you?
 - WHO were you with?
 - HOW hungry were you?
- what factors influenced
 - WHAT you ate?
 - WHY you ate?
 - HOW much you ate?

Biological and physiological factors

- sensory information
- rate of growth (increased hunger levels)
- things like budget, time available for cooking, general health, etc

Cognitive and psychological factors

- past experiences
- cultural practices
- religious teachings

- things learned at school, home, media, internet
- emotional stress level and mood
- positive and negative associations

Environmental factors

- cost
- proximity/accessibility to food/stores/kitchen
- government policies (subsidization)
- food distribution and availability
- food marketing
- store layout

Expert advice factors

- registered dietitian nutritionists
 - college trained healthcare professional who has extensive knowledge of foods, nutrition, dietetics, and the application of nutrition and food info to achieve and maintain optimal health
- master's degree
- extensive supervised practice hours
- pass national registration exam
- complete ongoing continuation education

Key nutrition concepts

- most foods are mixtures of nutrients
- variety, moderation, and balance can help ensure a diet's nutritional adequacy
- food is the best source of nutrients
- foods and the nutrients they contain are only one of many components of health
- malnutrition includes overnutrition as well as undernutrition
- nutrition is a dynamic science

nutrient density

nutrient dense foods have:

- more key nutrients relative to its total kcal per serving
- less solid fat, added sugars, refined starches

to find the nutrient density, divide the amount of nutrients by the kcals.

ex:

whole milk has 300mg calcium / 140 kcals = 2.14 mg Calcium per kcal

skim milk has 300 mg calcium / 80 kcals = 3.75 mg Calcium per kcal

energy density

- amount of energy (kcals) a food provides per given weight of food
- energy dense food often have empty kcals (kcals from unhealthy solid fats and added sugars)

9/9/2025, ch 1 cont.

participation points (must have 100 pts by end of semester) can be from attendance, cooking demos on campus (have to register for these), or a 1 on 1 dietitian consultation (also have to sign up for a time slot). Can only get points for 1 demo/session a month.

Calendar check in:

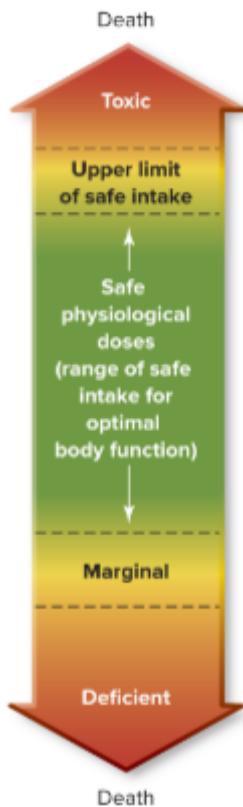
assignment 2 and workbook 2 are due this saturday
first exam is due on sat sep 27th, will open on the 23rd. open book open notes,
but check if need to print/email to yourself, etc
resources page has study guides, practice questions, and a practice exam

variety, moderation, balance

- variety: each food group
- moderation: reasonable amounts
- balance: supports maintenance of a healthy weight

food is the best source of nutrients

Food	Supplements
efficient	convenient
relatively inexpensive	may fill a nutrient need
contains a mix of nutrients	not regulated by FDA prior to being sold on the market
contains phytochemical, etc.	expensive
	may contain only one nutrient
	high amounts of one nutrient may decrease absorption of another



Malnutrition: under *and* overnutrition

- malnutrition: a state of health that occurs when the body is improperly nourished
- there are risks with excessive intake *and* under consumption
- nutritional status does not always correlate with weight

what are risk factors for malnutrition?

- food deserts or insecurity
- allergens or food restrictions
- eating disorders or psychological factors
- chewing problems
- limited access to food

Nutrition is a dynamic science

- research continues to evolve
- as such, nutrition recommendations do as well
- individual needs may vary

end of chapter 1, review question

which of the following is *not* a key nutrition concept?

- Foods and the nutrients they contain are not cure-alls.
- The best way for people to obtain all the essential nutrients is to consume dietary supplements.***
- Variety, moderation, and balance can help ensure a diet's nutritional adequacy.
- Malnutrition includes over-nutrition as well as under-nutrition.

Ch. 2 Evaluating Nutrition Info

The scientific method

1. Observation
2. Hypothesis
3. Literature review
4. Experiment
5. Analysis and interpretation
6. Dissemination
7. Conduct more research

Anecdote = account/testimonial of a personal experience or event

Follow up questions/evaluating research considerations:

- was the hypothesis supported?
- do we have enough information to establish a theory?
- did they have a control group?
- was there randomization?
- what is the sample size?
 - typically larger is better
 - mention of a sample size/power calculation is preferred
- what is the p-value?
 - p-value <0.05 indicates statistical significance
 - indicates that there is less than a 5% chance that the findings were due to chance

Publishing research

- peer review
- parts of a research article
 - abstract
 - review of literature
 - methodology
 - results
 - conclusions
 - references

sample size / power calculation

- The sample size and power calculation were calculated on the following assumptions: an incidence rate in the low-fat group of 4 events per 100 person-years that would amount to 24.9% of absolute cumulative incidence after 7 years, a hazard ratio (HR) of 0.7, and statistical power of 80%, with two-tailed $\alpha=0.05$. Under these assumptions, the required sample size was 491 patients in each of the two groups

P-value

- in men...primary endpoints occurring in 67 (16.2%) of 414 men in the Mediterranean diet group versus 94 (22.8%) of 413 men in the low-fat diet group (multiadjusted HR 0.669 [95% CI 0.489– 0.915], log-rank p=0.013)
- There was no differences when comparing the two diets among women (p=0.25)

Review

A study assesses the change in knowledge following an educational intervention. Which of the following groups had a statistically significant improvement in their knowledge?

- A. Older adults (4.5 ± 1.25 to 4.6 ± 1.36 , p=0.87)
B. College students (3.9 ± 0.6 to 5.9 ± 1.6 , p=0.03)
C. High school students (4.1 ± 1.56 to 5.7 ± 5.5 , p=0.51)
D. Elementary school students (1.2 ± 2.5 to 1.1 ± 3.2 , p=0.67)

Types of research studies

Lab Research: Test tube studies (in vitro)

Type of study/definition	Pros	Cons
Studies performed in a test tube allow scientists to study the effect of a specific nutrient on a specific cell type in controlled environment	controlled environment few confounding variables	results from a test tube may not be observed in a human
		relatively expensive

Confounding variables – factors that are not being studied may influence the outcome of the research

Lab Research: animal studies (in vivo)

Type of study/definition	Pros	Cons
Because of safety and ethical concerns, nutrition scientists often conduct experiments on animals before performing similar research on humans	preliminary research is done on animals instead of humans	results from animal studies may not be observed in a human study
	helps inform future studies with humans	

Lab Research: observational studies

Type of study/definition	Pros	Cons

Type of study/definition	Pros	Cons
Epidemiology is the study of the occurrence, distribution, and factors that may contribute to health problems in populations	inform future experimental (intervention) studies	observational studies cannot establish cause-effect relationships
physical health data		healthy-user bias
surveys		

types:

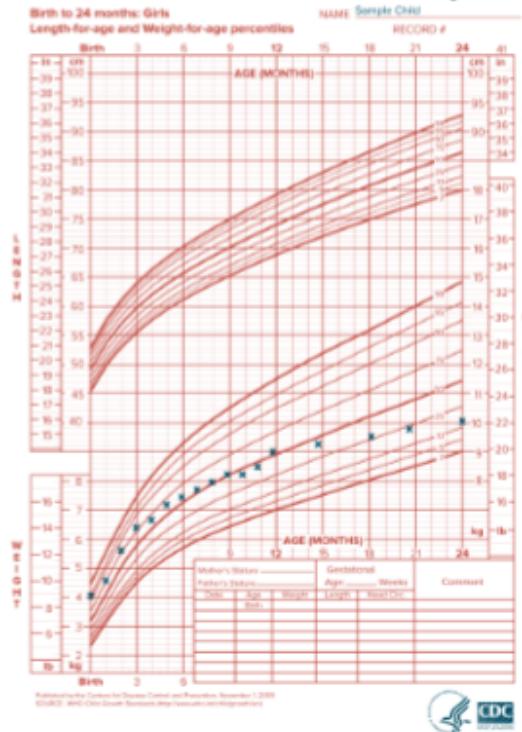
- cross-sectional
- case-control
- cohort

Observational studies: Cross-sectional

- looking at a "snapshot" of one point in time
- identify factors that may influence disease in a certain population

Cross-Sectional Study: NHANES

- National Health and Nutrition Examination Survey



Cross Sectional Study: Kashin Beck Disease



<http://www.kbdfund.org>



Observational studies: case control

- individuals with a health condition (cases) are compared to individuals with similar characteristics who do not have the condition (controls)

• Case = people with a goiter

- Iodine deficient

• Control = people without a goiter

- Not iodine deficient



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Observational studies: Cohort

- in a cohort study, epidemiologists collect and analyze various kinds of information about a large group of people over time
 - retrospective or prospective

Human Research: Experimental studies

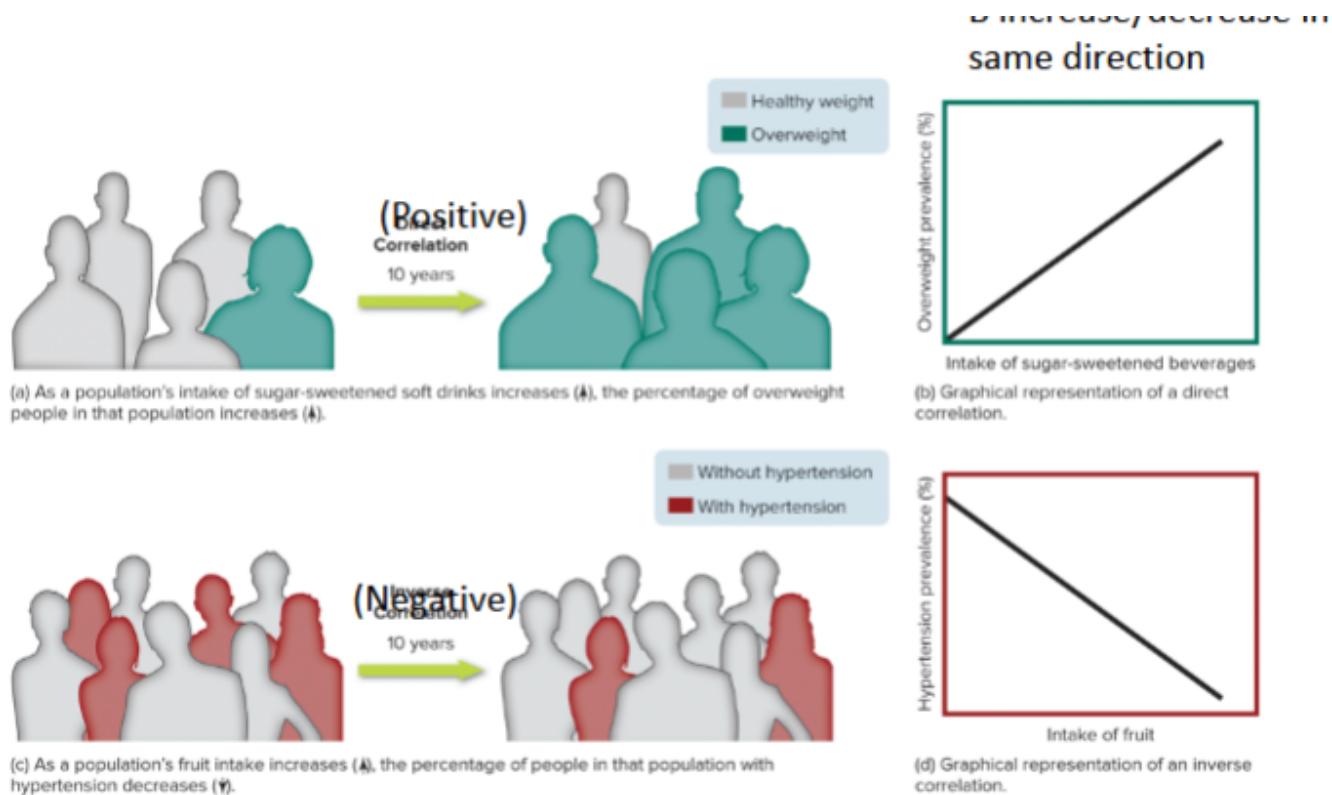
Type of study/definition	Pros	Cons
In experimental studies, certain aspects of the diet are changed, and health outcomes are assessed	gold standard = randomized controlled trials (RCTs)	specific inclusion criteria may decrease generalizability
specific inclusion criteria		real life does not have controlled, ideal conditions

9/11/2025

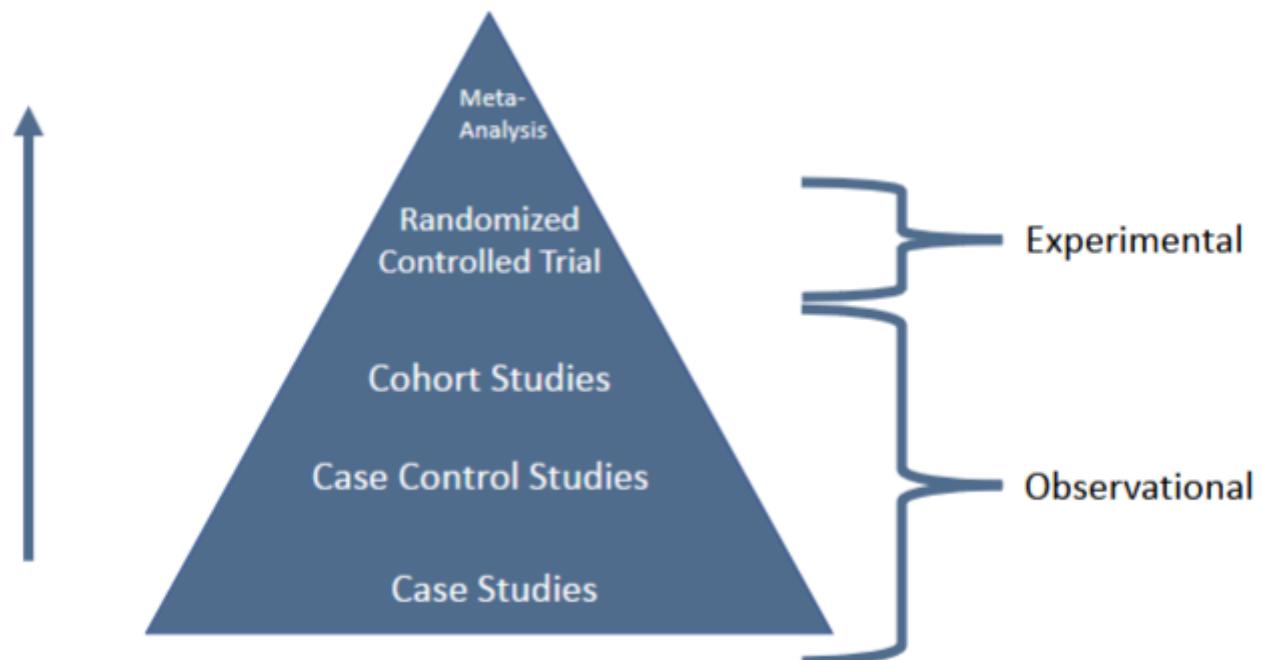
Correlation types

positive correlation: A and B increase or decrease in the same direction

Negative correlation: A and B increase or decrease in opposite directions



levels of research evidence



Review: what type of study?

- **Combined Iron Deficiency and Low Aerobic Fitness Doubly Burden Academic Performance among Women Attending University**
- Correlations between female students' GPA and iron levels & VO_{2peak} were conducted.

a: cross-sectional

- **Examining the Weight Trajectory of College Students**
 - Study that measures weight gain among college students over the course of 4 years
- a) Cross-sectional
- b) Case Control
- c) Cohort
- d) Animal Study
- e) In Vitro Study
- f) Human (Clinical) Trial

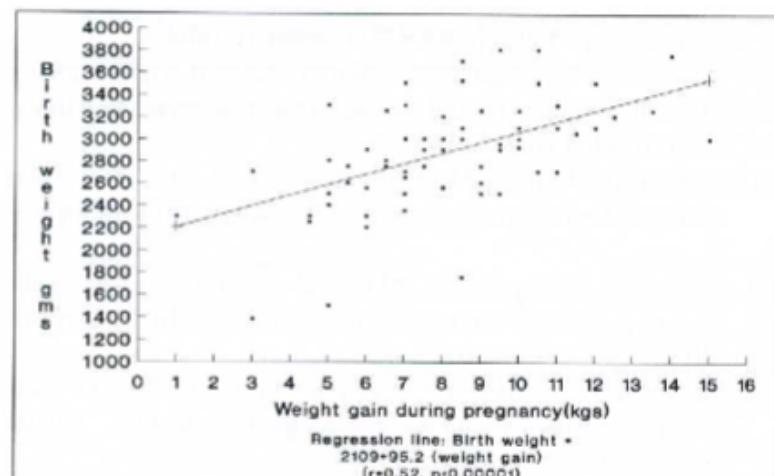
a: cohort

- **Effects of Walnut Consumption on Mood in Young Adults**
 - Sixty-four college students were randomly assigned to one of the following treatment sequences:
 - Walnut, placebo
 - Placebo, walnut
 - Mood was assessed before and after treatment

a: human (clinical) trial

Review: what type of correlation?

- The more weight gained by the mother during pregnancy, the higher the birth weight of the infant

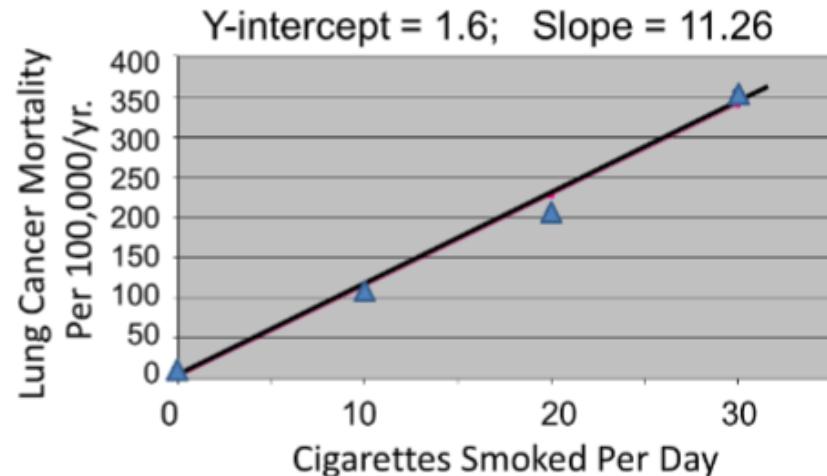


- a) Positive Correlation
- b) Negative Correlation

Figure 1. Influence of weight gain during pregnancy on birth weight

a: positive correlation

- The more cigarettes a person smokes per day, the higher the mortality rate



- a) Positive Correlation
- b) Negative Correlation

a: positive correlation (note that positive correlation does not always mean positive outcome)

Nutrition info: fact or fiction

Features of unreliable sources of nutrition info

1. promises of quick and easy remedies
2. claims that sound too good to be true
3. scare tactics

4. attacks on conventional scientists and nutrition experts
5. testimonials
6. promotion of benefits while overlooking risks
7. vague, meaningless, or scientific-sounding terms
8. vague sources
9. pseudoscience
10. disclaimers

Finding credible sources of nutrition info

- motivation
 - health promotion vs selling something
 - .com vs .org or .gov
 - nationally recognized health organization?
- source
 - nutrition expert vs PhD
 - reviewed by experts vs blogs or magazines
- evidence based?
 - references to pertinent, high quality, peer reviewed research?
 - population similar to me?

Review : credible sources of nutrition info

Which of the following is NOT an indication that the source of information is credible?

- a) **Provides testimonials**
- b) References peer-reviewed journal articles
- c) Can be found at a .edu website
- d) Is written by a registered dietitian

Ch. 3 Basis of a healthy diet

Nutrient Requirements

- smallest amount of a nutrient that maintains a defined level of nutritional health
- consuming the recommended amounts of nutrients can support maintenance of nutrient storage and help prevent deficiency
- many factors can influence nutrient needs
 - age
 - sex
 - lifestyle
 - general health status
 - illness

Nutrient and calorie standards

Dietary Reference Intakes (DRI)

Nutrition experts review thousands of research studies to develop standards for energy, nutrients, etc. that

best support health.

Important notes about DRI

- varies by age, gender, life stage
- aim to reduce risk of chronic disease and avoid unhealthy excess
- should be used as a *guide* for overall intake of food over time
- estimated average requirement (**EAR**)
 - meets the needs of 50% of population
 - used to calculate RDA
- Recommended Dietary Allowance (**RDA**)
 - EAR + a margin of safety
 - meets the needs of 97%-98% of the population
- Tolerable Upper Level Intake (**UL**)
 - exceeding this amount may result in toxicity
 - may be exceeded with supplements
 - not likely to be exceeded with food
- Adequate Intake (**AI**)
 - not enough research to establish a DRI
 - amount that healthy populations consume
- Estimated Energy Requirement (**EER**)
 - average dietary energy intake (kcals/day) that will maintain energy balance in a person who has a healthy body weight and level of physical activity

Acceptable Macronutrient Distribution Range (AMDR)

Range of intakes for the energy nutrients that provide adequate energy and nutrients and reduce the risk of chronic disease.

- carbs: 45-65% of kcals
- fat: 20-35% of kcals
- proteins: 10-35% of kcals

If John needs 2300 kcals/day, according the AMDR:

- $2300 * 0.2 = 460$ kcals (low end)
- $2300 * 0.35 = 806$ kcals (high end)
- John should be getting 460-806 kcals from fat

Steven needs 4000 kcals each day. How many kcals from protein?

$4000 * .10 = 400$ kcals from protein

$4000 * .35 = 1400$ kcals from protein

How many grams of protein should he consume?

$400 \text{ kcals} / 4 = 100 \text{ grams}$

$1400 \text{ kcals} / 4 = 350 \text{ grams}$

Major food groups

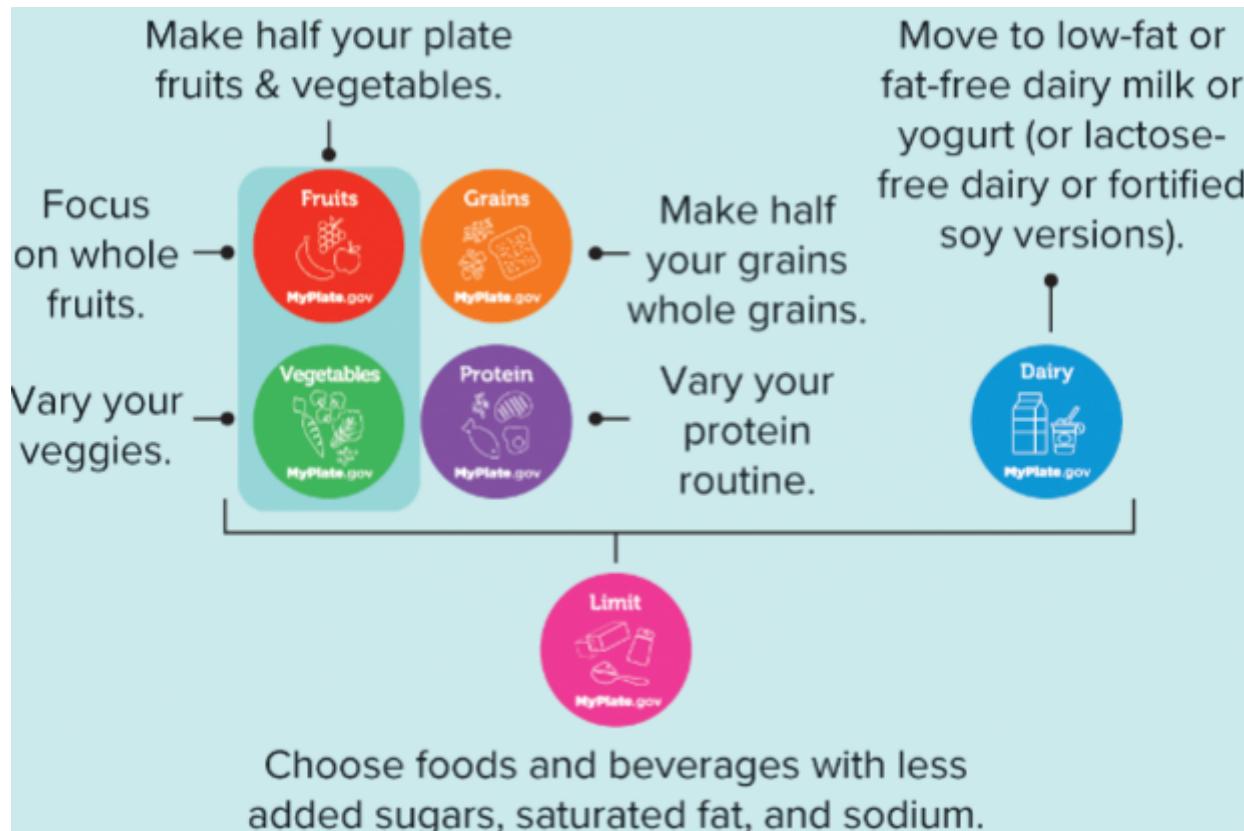
- grains
- dairy
- protein
- fruits
- vegetables
- oils (USDA doesn't count as a separate food group)

Enrichment and fortification

- enrichment is the replacement of some nutrients that were removed during processing
 - iron (mineral, all the rest in list are vitamins), thiamin, riboflavin, niacin, and folic acid added back into grain products such as white flour or white rice
 - taken out, then added back in
- fortification is the addition of nutrients to any food
 - calcium to orange juice
 - vitamin A and D to milk
 - vitamins and minerals to ready-to-eat cereals
 - stuff that wasn't there originally, but is added in as a helpful extra

2020 - 2025 dietary guidelines

1. follow healthy eating at every stage of life
2. customize and enjoy nutrient-dense food and beverage choices that reflect personal preferences, cultural traditions, and budgetary considerations
3. focus on meeting food group needs with nutrient dense foods and beverages, and stay within calorie limits
4. limit foods and beverages high in added sugars, saturated fat, and sodium, and limit alcoholic beverages



Major sources of empty kcals

- cakes, cookies, pastries
- sugar sweetened beverages
- cheese and pizza
- ice cream
- fatty meats such as sausage, bacon, hot dogs, and ribs

Food labels

- found on most foods other than:
 - fresh produce and meats
 - those contributing few nutrients
 - tea
 - coffee
 - spices
 - foods produced by small businesses

Daily values (DVs)

- set of nutrient intake standards developed for labeling purposes
- the % DV tells you how much a nutrient in a serving of food contributes to a daily diet
 - 2000 kcal diet is used as the reference

Ingredient List

- **must** list all ingredients
- listed in descending order by weight

- gives insight into the nutritional quality of the product

Ingredients to watch for

sugars	whole grains
sugar	oats
high fructose corn syrup	whole grain wheat
honey	brown rice
sucrose	buckwheat
fructose	bulgur
maltose	popcorn
malt syrup	
rice syrup	

note: some rounding is allowed on food labels

Other label components

- serving size + servings per container
- required nutrients
 - total fat
 - saturated fat
 - trans fat
 - cholesterol
 - sodium
 - total carbohydrate
 - fiber
 - total sugars
 - added sugars
 - protein
 - vitamin D
 - potassium
 - calcium
 - iron

claims on labels

- **nutrient claims:** statements that characterize the quantity of a nutrient in a food
- examples
 - "rich in calcium"
 - "high in fiber"
- **health claims:** statements that characterize the relationship between a nutrient in a food and a disease
- example
 - diets low in sodium may reduce risk of high blood pressure

- **structure function claims:** statements that characterize the relationship between nutrient and its role in the body
- **do not require FDA approval**
- example
 - calcium builds strong bones

ch 4 human digestion, absorbtion, and transportation

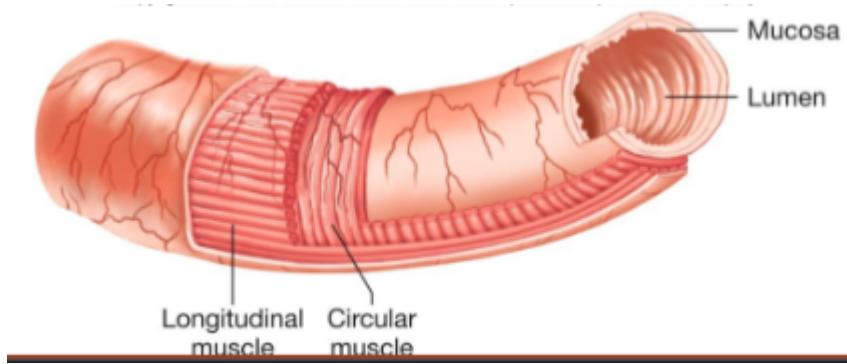
overview of digestive system

primary roles of the digestive system:

- break down food into nutrients (digestion)
- absorbtion of nutrients from digestive tract into the blood or lymph for transport to cells
- elimination of solid waste products

Gastrointestinal (GI) tract

- flexible muscular tube that extends from the mouth to the anus
- sphincters (circular muscles that are able to close a body opening) help regulate the flow of food particles
- the innermost layer is called the mucosa
- the empty space inside this tube is called the lumen



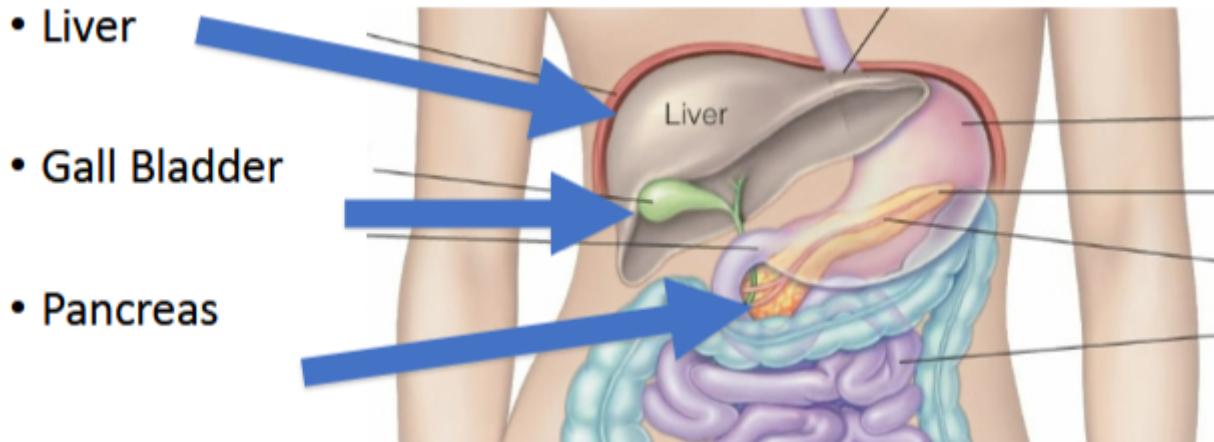
order of the GI tract

- mouth
 - epiglottis (covers trachea, lets you swallow)
 - upper esophageal sphincter
- esophagus
 - lower esophageal sphincter (sometimes also called the cardiac sphincter)
- stomach
 - pyloric sphincter
- small intestine (*duodenum, jejunum, ileum*)
 - ileocecal sphincter
- large intestine (colon)
 - cecum

- rectum
- anus

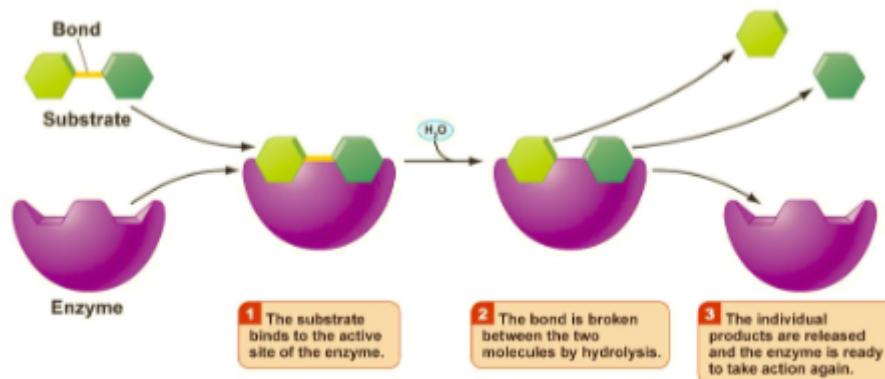
accessory organs

- liver
- gall bladder
- pancreas



digestion of foods into nutrients

- mechanical digestion
 - physically breaking down food into smaller pieces
- chemical digestion
 - breaking chemical bonds, requires enzymes
 - digestive enzymes: proteins found in digestive juices that act on food substance, causing them to break down into simpler compounds at a rapid rate
 - names often end in "-ase"

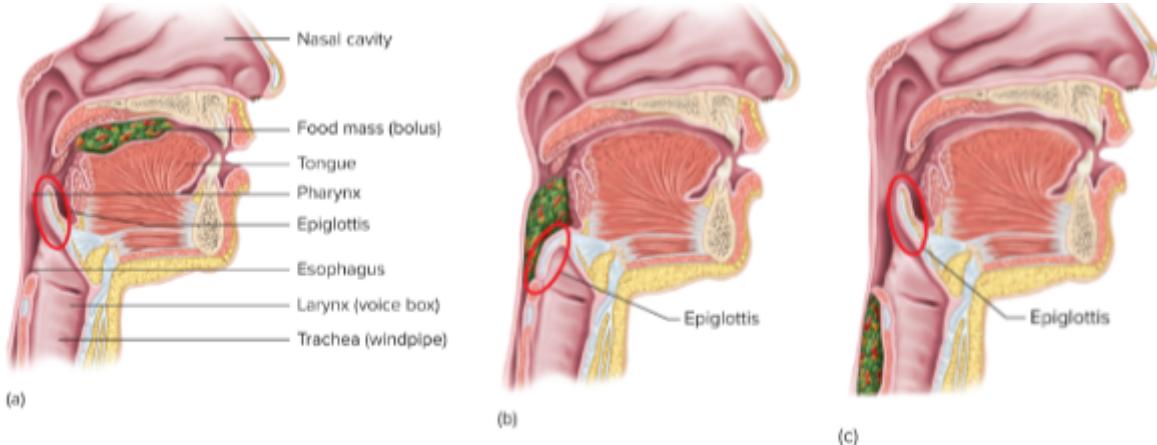


mouth

- mechanical digestion
 - chewing
- chemical digestion
 - enzyme: salivary amylase (CHO)
 - enzyme: lingual lipase (FAT)
- chewed up food + saliva = bolus

esophagus

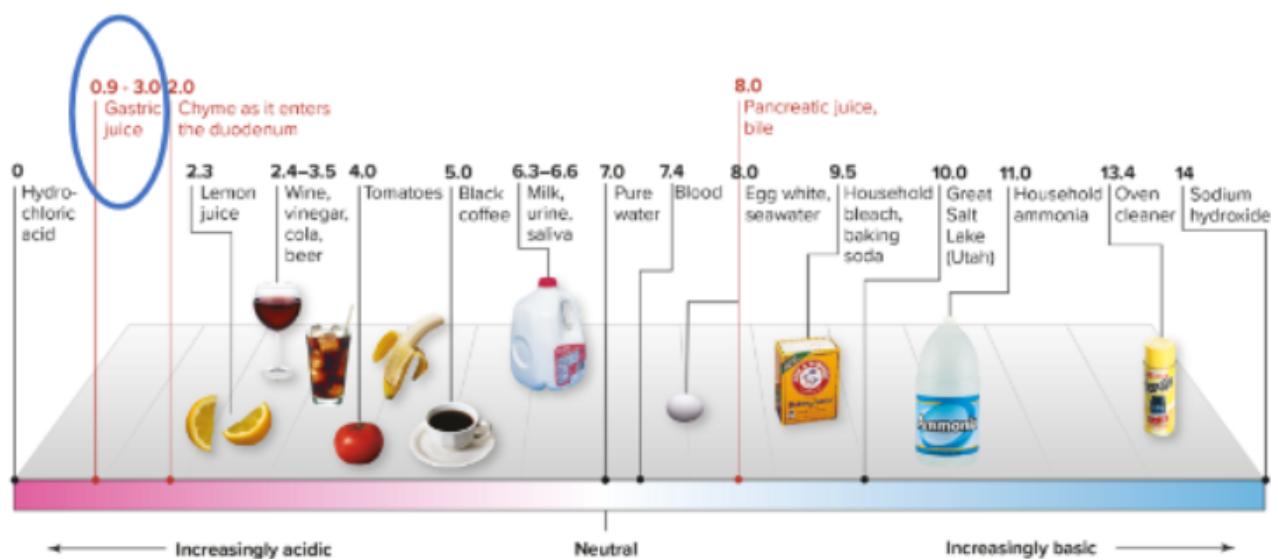
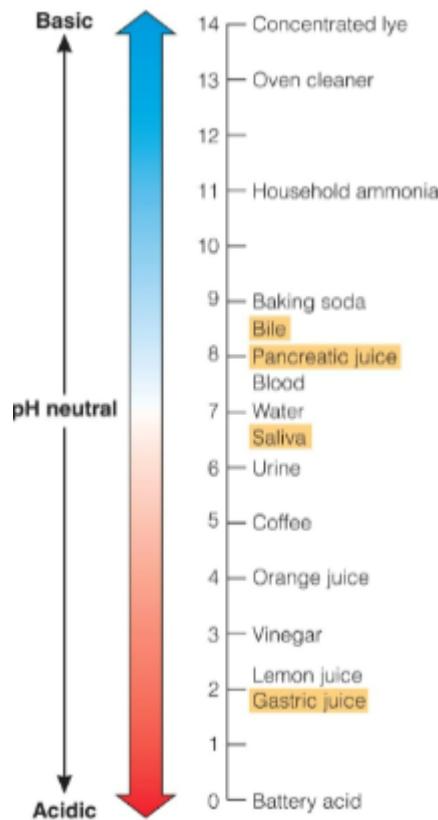
- swallowing
- reflux occurs when the lower esophageal sphincter does not stay closed and HCL irritates the esophagus
- peristalsis: waves of muscular contractions that help move material through the esophagus



stomach

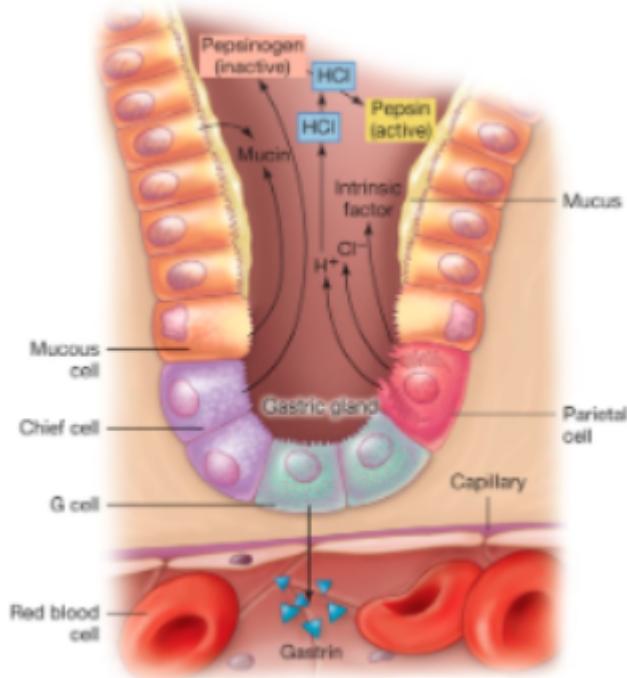
- size: 1 cup (empty) - 1 gallon (very full, usually throw up before hitting this point)
- lower esophageal sphincter
- bolus + gastric juices = chyme
- pyloric sphincter
- mechanical digestion
 - peristalsis via strong gastric muscles
- chemical digestion
 - hydrochloric acid (HCL) denatures protein
 - pepsinogen → pepsin, breaks down protein
 - gastric lipase breaks down fat

pH



gastric secretions

- mucous cells
 - mucin + water = mucous (protects the lining of the stomach)
- chief cells
 - lipase and pepsinogen
- parietal cells
 - HCl, intrinsic factor (needed for absorption of B12)
- G-cells
 - gastrin, hormone that stimulates stomach motility and secretions
 - targets parietal cells and chief cells



small intestine

where most of the digestion/absorbtion of nutrients happens

- duodenum
 - 10 inches
- jejunum
 - 3-5.5 feet
- ileum
 - 5-9 feet
- ileocecal sphincter

DJI = dont jump in

- mechanical digestion
 - peristalsis
 - segmentation
- chemical digestion
 - enzymes secreted from the lining of the small intestine [mucosa] (eg lactase)
 - secretions from accessory organs

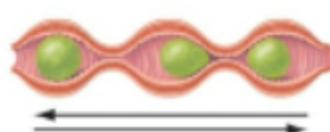
goblet cells produce mucus

Peristalsis



1 Longitudinal, circular, and diagonal muscles constrict in wavelike motions to propel food through the GI tract.

Segmentation



2 Longitudinal and circular muscles in the small intestine mix and squeeze food back and forth along the intestinal wall.

accessory organs

- liver
 - makes bile
- gallbladder
 - stores bile
- pancreas
 - bicarbonate
 - neutralize acidic stomach contents
 - amylase (CHO)
 - peptidases (PRO)
 - lipase (FAT)

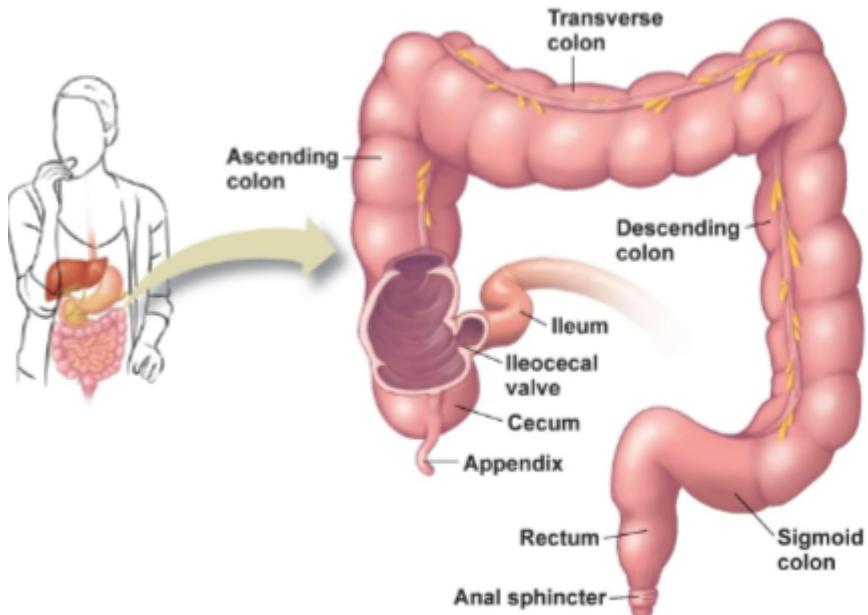
Hormonal regulation of digestion

prompt	hormone	result
food in stomach	gastrin	stomach motility and gastric gland secretion
acid chyme in the small intestine	secretin	pancreas and liver to release bicarbonate
fat in small intestine	cholecystokinin (CCK)	secretion of bile and pancreatic enzymes

large intestine (colon)

- size = 5 feet
- time: stool passes through the colon within 12-70 hours
- ileocecal valve
- cecum
- ascending colon
- descending colon
- transverse colon
- rectum (6 inches)

- anus

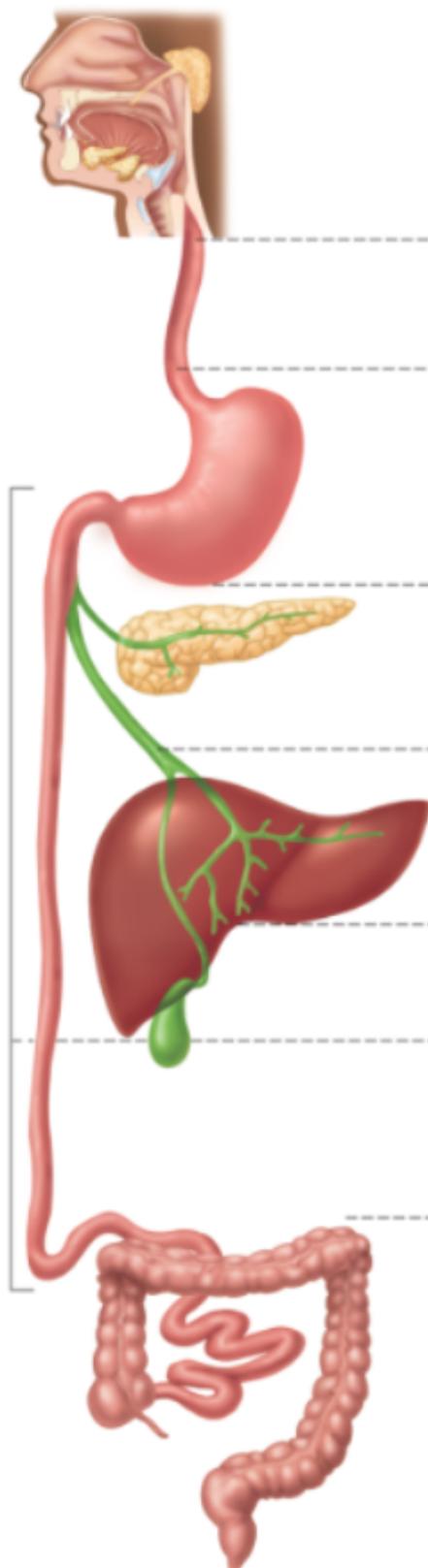


mechanical digestion:

- peristalsis
- secretion of mucous from goblet cells

chemical digestion:

- fermentation



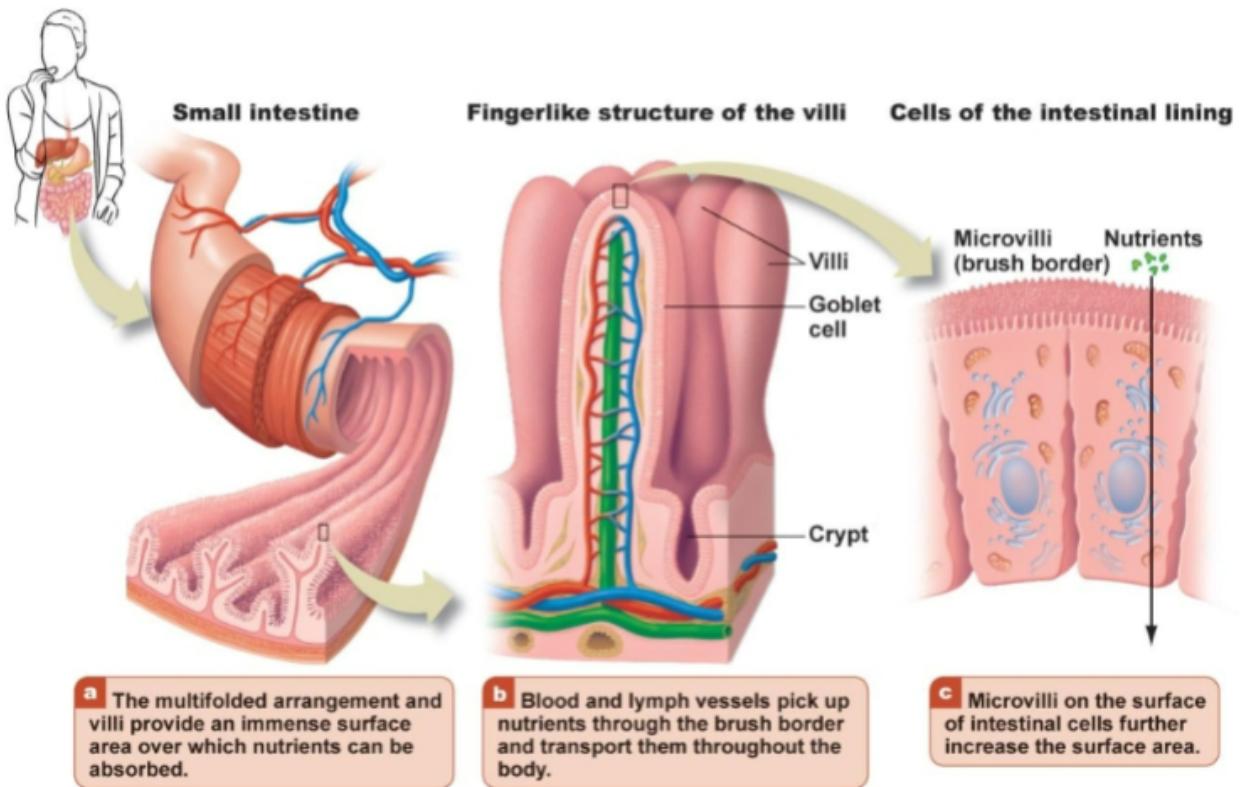
Organ	Secretions	Digestive Functions
Mouth and salivary glands	Saliva and water	Moisten food
	Mucus	Lubrication
	Amylase	Starch-digesting enzyme
Teeth		Chew
Esophagus		Moves food to stomach by peristaltic waves
	Mucus	Lubricates food
Stomach		Stores, mixes, dissolves, and continues digestion; regulates emptying of chyme into small intestine
	HCl	Kills microbes; activates pepsinogen to pepsin
	Pepsin	Digests proteins
Pancreas	Mucus	Lubricates and protects stomach wall
	Enzymes	Secretes enzymes and bicarbonate
	Bicarbonate	Digest carbohydrates, fats, proteins, and nucleic acids
Liver		Neutralizes HCl entering small intestine from stomach
		Receives water-soluble products of digestion from small intestine
	Bile salts	Synthesizes and secretes bile
Gallbladder		Aid fat digestion
		Stores and concentrates bile between meals
		Releases bile during meals
Small intestine		Digests and absorbs most substances; mixes and propels contents
	Enzymes	Food digestion
	Water	Maintains fluidity of intestinal contents
Large intestine	Mucus	Lubricates inner walls
		Stores and concentrates undigested matter; absorbs some minerals and water; eliminates wastes
		Lubricates mucosa

Absorption of nutrients

- some occurs in the mouth and stomach
- most absorbtion of nutrients occurs in the small intestine

- villi and microvilli

Absorption in the Small Intestine

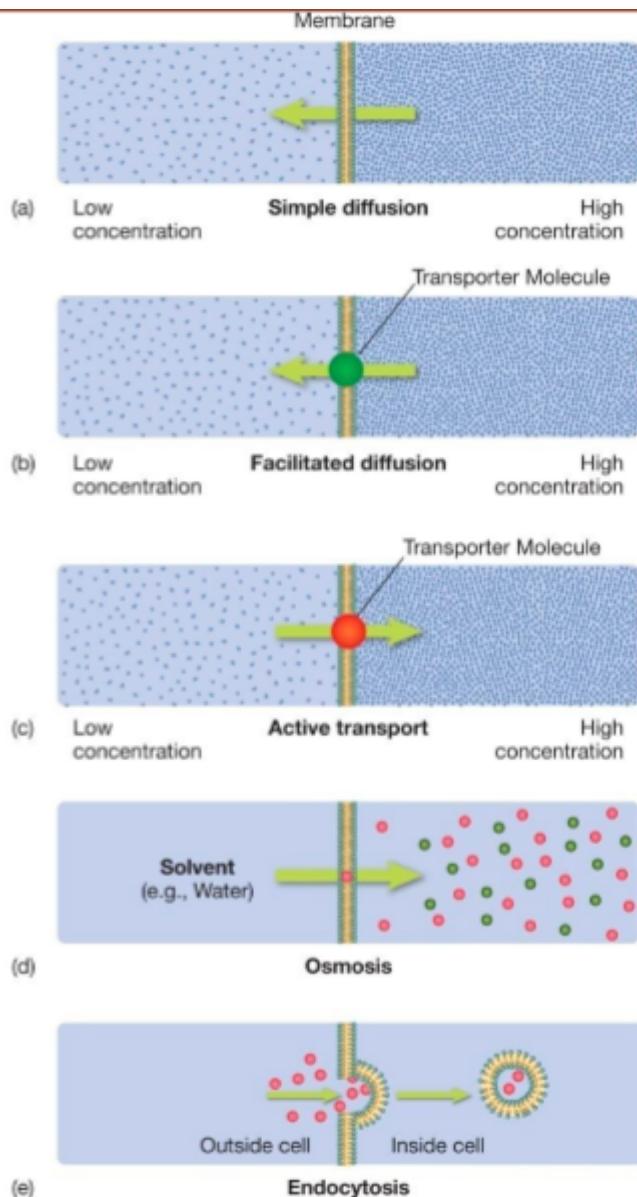


absorbtion in the large intestine

- absorbtion of water and electrolytes takes place in the large intestine
- feces is typically 75% water
 - remaining material is bacteria and undigested fiber

nutrient absorbtion can occur by:

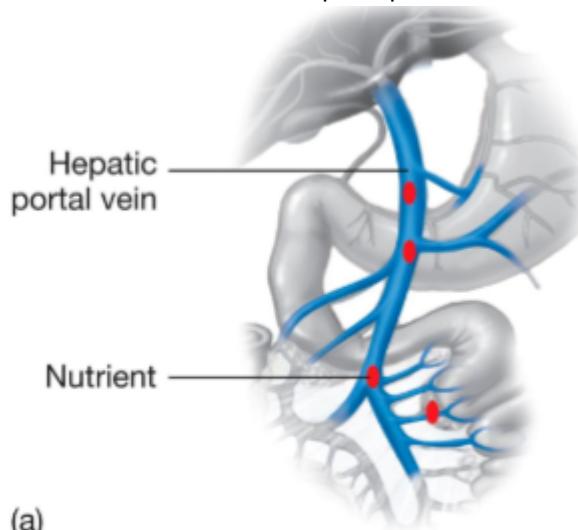
- simple diffusion
- facilitated diffusion
- active transport
- osmosis
- endocytosis



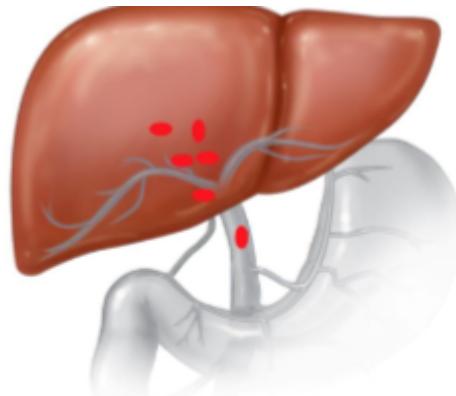
Transport

water soluble nutrients and certain fats are absorbed into the capillary network

- travel to the liver via the hepatic portal vein



(a)



(b)

- water soluble nutrients: intestines --> blood --> liver --> heart --> rest of body
 - folate
 - biotin
 - pantothenic acid
 - vitamin C
 - vitamin b12
 - thiamin (b1)
 - riboflavin (b2)
 - niacin
 - pyridoxine (b6)
- fat soluble nutrients: intestines --> lymph --> heart (blood) --> rest of body
 - vitamin A
 - D
 - E
 - K

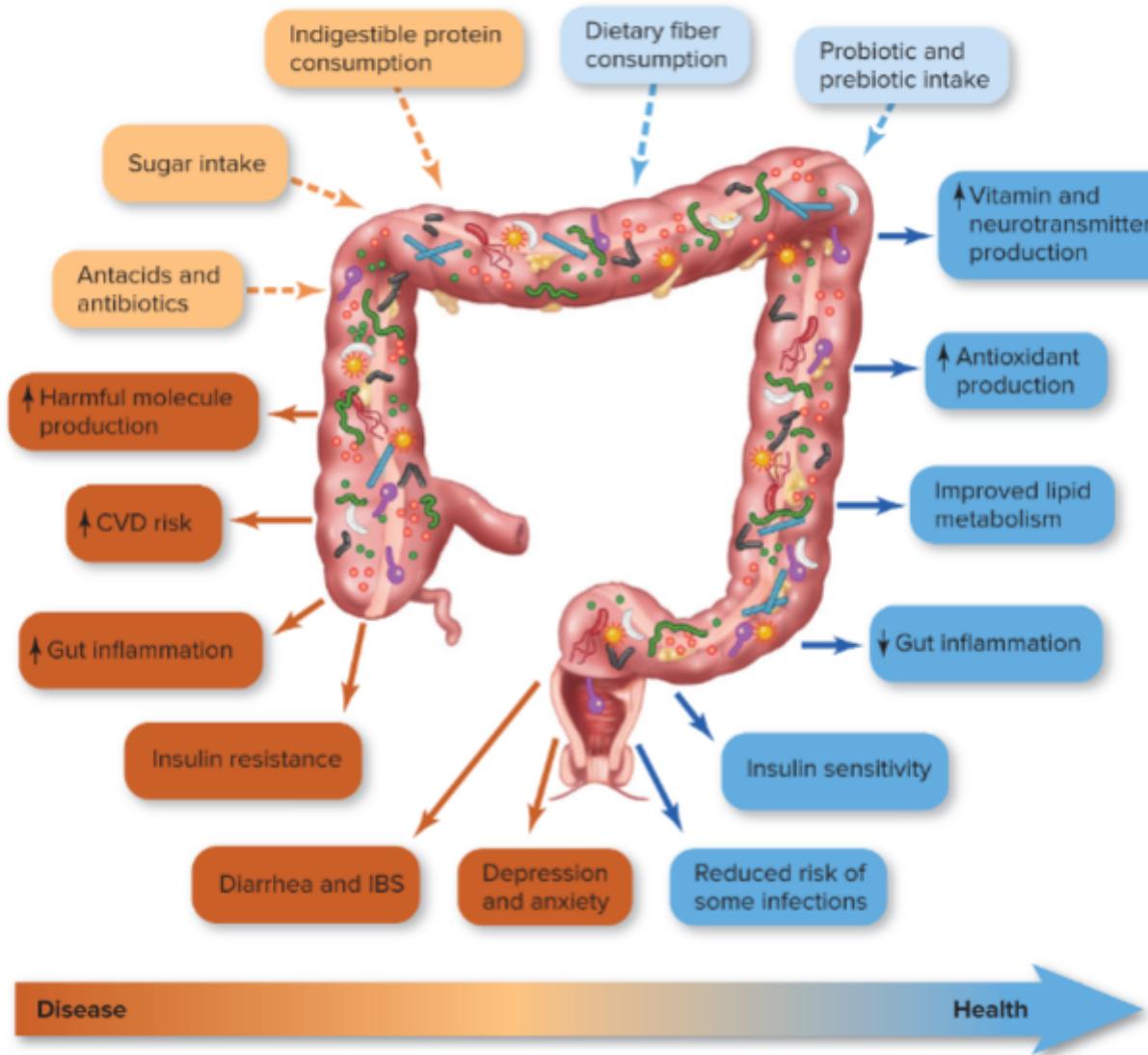
Defecation

expulsion of fecal material from the body

feces: waste matter discharged from the colon

Microbes in the digestive tract

- the large intestine has vast numbers of various types of bacteria (called the gut microbiota)
- having a healthy gut microbiota promotes health
- use of antibiotics to fight bacterial infections can affect gut microbiota
 - use of probiotics may be beneficial to support restoration of the gut microbiota



- may be affected by diet
 - prebiotics: promote growth of beneficial bacteria like fiber
 - probiotics: live bacteria that may crowd out bad bacteria in the body
 - often used to prevent diarrhea due to antibiotic use
 - e.g. yogurt with live cultures, sauerkraut, supplements
- research regarding probiotics is not conclusive. The gut microbiota is a complex ecosystem, and probiotic needs likely vary from person to person
- microbes in the digestive tract are beneficial, and functions include:
 - metabolize undigested food (fermentation)
 - synthesizes short chain fatty acids
 - energy used by cells of the colon
 - may decrease risk of colon cancer
 - produces vitamin K, folate, B6, B12, biotin, and gas

common digestive tract disorders

- too slow digestion
 - constipation

- may be due to IBS
- too fast digestion
 - diarrhea
 - may be due to IBS/IBD
- abnormalities in GI wall
 - diverticulosis/itis
 - hemorrhoids
- coming up from the stomach
 - vomiting
 - GERD
- sores in the GI tract
 - peptic ulcer
 - crohn's disease (auto-immune; whole GI)
 - ulcerative colitis

Gastroesophageal Reflux disease (GERD)

- characteristics
 - chronic reflux of stomach acid into the intestine
 - may damage the esophagus
- prevention/treatment
 - lose excess body weight
 - do not lie down after eating / elevate the bed
 - avoid overeating
 - avoid smoking and secondhand smoke
 - avoid tight clothing
 - avoid dietary triggers
 - alcohol
 - coffee
 - chocolate, peppermint, greasy or spicy foods, tomatoes

Vomiting

forcible or involuntary emptying of stomach contents through the mouth

- avoid solid foods/drink clear liquids until symptoms subside
- seek medical help if prolonged or if there is blood present

Gastric ulcer

- characteristics
 - sore in the lining of the stomach or upper small intestine
 - pain 2 hours after eating
 - helicobacter pylori is responsible for most cases
- prevention/treatment
 - avoid NSAIDs, alcohol, smoking
 - antibiotics + medications to reduce stomach acid production
 - avoid spicy foods when an ulcer is present

Constipation

- characteristics
 - infrequent bowel movements ( /week) and feces that are difficult to eliminate
 - risk increased by: antibiotics, medications (including opiates), low fiber diet, low water intake, anxiety, depression, disrupted routines (e.g. surgery or vacation)
 - may increase risk for hemorrhoids
- prevention/treatment
 - increase fiber and water intake
 - try fermented foods, probiotic/prebiotic supplements

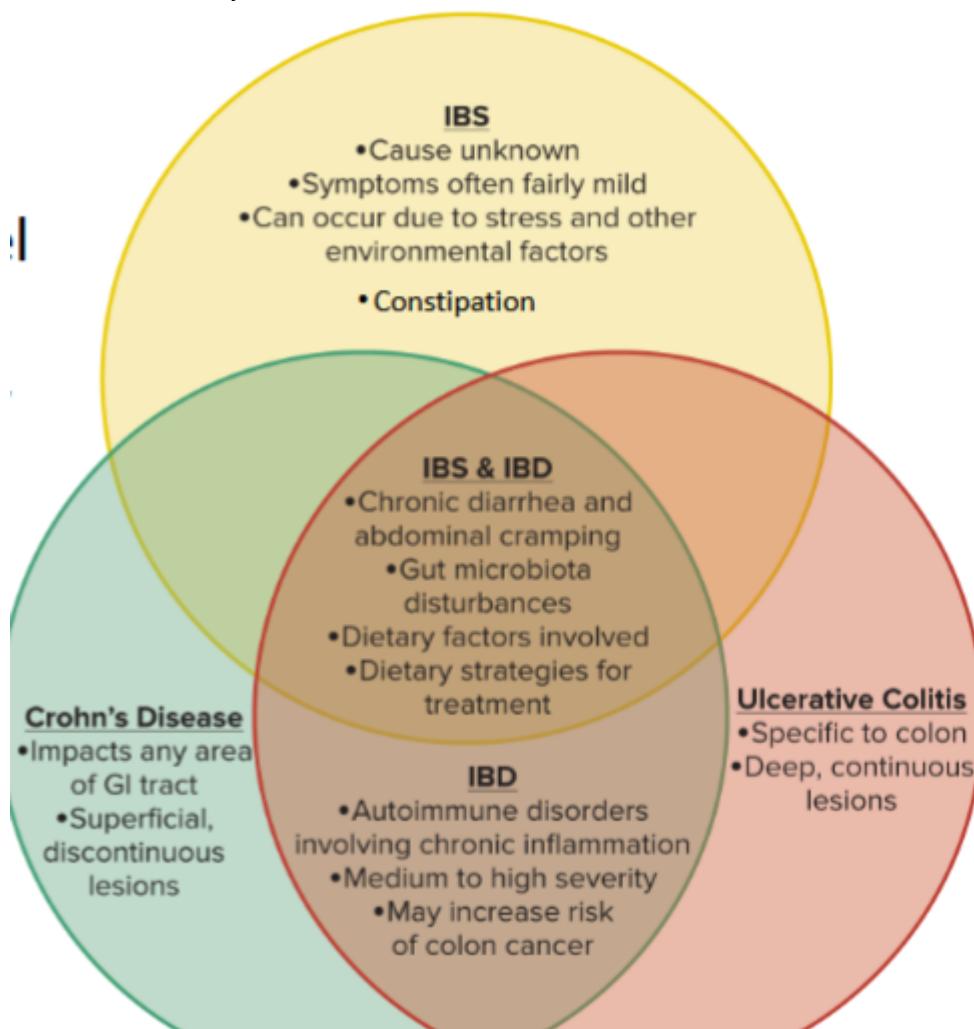
Diarrhea

- characteristics
 - frequent, watery bowel movements
 - decreased nutrient absorption
 - loss of electrolytes
- prevention/treatment
 - antidiarrheal medications
 - seek medical help for severe cases (especially for children and older adults), or if blood is present for 7 days

IBS / IBD

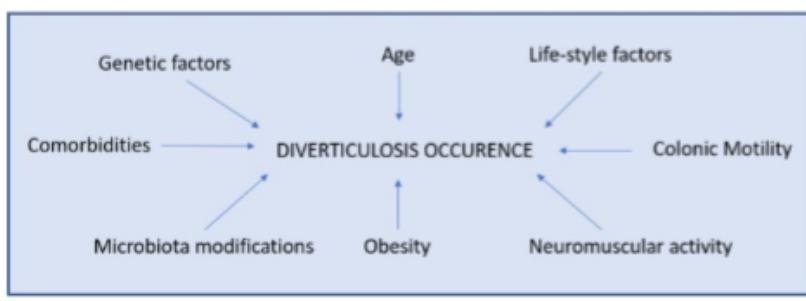
- IBS = Irritable bowel syndrome

- IBD = inflammatory bowel disease

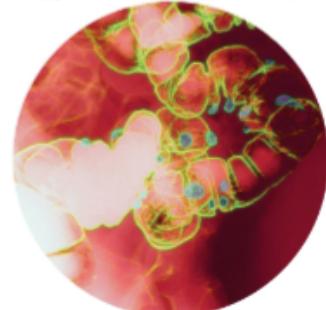


Diverticulosis/itis

- diverticulosis: tiny pouches (diverticula) that form in the inner lining of the large intestine and push through weak regions of the colon wall
- diverticulitis: inflamed diverticula due to infection from bacteria or feces



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Bile

Chyme is mostly water, so it does not mix with hydrophobic fat well. Bile helps this problem.

Bile is made in the liver, stored in the gallbladder, and released into the duodenum when fat being present in the small intestine stimulates the production of cholecystokinin (CCK).

Bile is an emulsifier because it is amphipathic (one side is hydrophylic [orients towards chyme] and the other is hydrophobic [orients towards fat]). This turns large fat droplets into smaller droplets as the droplets get

surrounded by bile and broken down by the lipase present in the chyme.

Exam 1 study

ch 1 - know

1.2 the nutrients

six classes of nutrients:

- carbs
 - major energy source
 - maintain blood glucose levels
 - eleimante solid waste from gastrointestinal tract (fiber)
- lipids (fats and oils)
 - major source of energy
 - cell development, physical growth
 - regulation of body processes (some hormones)
 - growth and development of brain
 - absorbtion of fat soluable vitamins
- proteins
 - formation of structural (muscle fibers) and functional (enzymes) components
 - cell development, growth, and maintenance
 - regulation of body processes (some hormones)
 - transportation of substances in the blood
 - minor source of energy
- vitamins
 - regulation of body processes
 - immune function
 - production and maintenance of cells
 - protection against agents that can damage cell components
- minerals
 - regulation of body processes (fluid balance, energy metabolism)
 - formation of some chemical messengers
 - formation of structural/functional components (various substances and tissues)
 - cell development, growth, maintenance
- water
 - maintenance of fluid balance
 - regulate temperature
 - eliminate wastes
 - transport substances
 - participates in many chemical reactions

typically, a body is 50-70% water. In young people most levels are about the same, but young women have less water and protein, and more fat.

Almost 98% of the body is made up of oxygen, carbon, hydrogen, nitrogen, or calcium.

	carbon	hydrogen	nitrogen	oxygen	phosphorus	sulfur	others
carbs	o	o		o			
lipids	o	o	x	o	x		
proteins	o	o	o	o		x	
vitamins	o	o	x	o	x	x	cobalt
minerals					x	x	sodium, magnesium, potassium, calcium, chromium, iron, copper, zinc, iodine, and others
water		o		o			

o = all nutrients in this class contain this element

X = some nutrients in the class contain this element

organic = contains carbon (carbs, lipids, proteins, vitamins), inorganic = no carbon (water, minerals)

Essential nutrients are dietary necessities because the body cannot make them (such as water) and a lack results in signs or symptoms of disease. Signs = measurable (rashes, atypical growth, elevated blood pressure) while symptoms = subjective complaints of ill health (dizziness, fatigue, headache).

Proteins (Amino					
Carbohydrates	Acids*	Lipids	Vitamins	Minerals	Water
Glucose§	The following amino acids are generally recognized as essential:	Fats that contain: Linoleic acid Alpha-linolenic acid	A Thiamin Riboflavin Niacin Pantothenic acid Biotin Folate B-6 B-12 C D [†] E K Choline [‡]	Major minerals: Calcium Chloride Magnesium Phosphorus Potassium Sodium Sulfur Trace minerals: Chromium Copper Iodine Iron Manganese Molybdenum Selenium Zinc	Water
	Histidine Leucine Isoleucine Lysine Methionine Phenylalanine Threonine Tryptophan Valine				

Conditionally essential nutrients can become essential under certain conditions when the body cannot make adequate amounts (ex: during metabolic disorders, serious diseases, prenatal development)

Carbs, fats, and proteins are macronutrients (energy sources), while vitamins and minerals are micronutrients. water is not classified as a macronutrient since it doesn't provide energy.

1.3 food as fuel

calorie = 1g(mL) water raised by 1 degree C

Calorie or kcal = 1L water raised by 1 degree C

direct calorimetry means to burn the food and measure the energy output.

1 gram of	kcals
carbs	4
protein	4
fat	9
alcohol	7

1.4 risk factors

Risk factors = attribute/characteristic/exposure that increases a person's chances of developing a chronic disease (such as heart disease, diabetes, cancer).

Genetic makeup does not entirely determine a person's likelihood of developing these issues, lifestyle is also a large part (unsafe environmental conditions, psychological factors like stress, social determinants of health equity, lack of access of healthcare/food, advanced age, etc).

Perform 60+ minutes of physical activity for every 8 hours of sedentary activity.

1.5 expert advice

registered dietitian nutritionist or registered dietitian = college trained health care professional with a master's degree.

1.6 concepts 1,2,5

concept 1

nutrient dense foods provide more key nutrients (protein, fiber, vitamins, minerals) in relation to total calories per serving, and has little to no solid fats/added sugars/refined starches/sodium.

Ex of nutrient dense foods = vegetables, low fat milk, fruits, lean meats, whole grain cereals

energy dense foods have a kcal to weight ratio of 4+. Fat supplies most energy per gram. These foods also tend to not be water dense.

foods can be both nutrient and energy dense! like nuts. But a lot of energy dense foods are also kind of empty calories

concept 2

variety is important in diet, but so is moderation. A healthy diet meets all the nutritional needs, and *then* can add in the occasional empty calories treat for enjoyment.

myPlate food groups = fruits, grains, vegetables, protein, dairy

concept 5

malnutrition = body is improperly nourished. This can be from over or under nutrition.

ch 1 - skim

1.1 importance of nutrition

important to study nutrition because it is the study of nutrients and how the body uses them. We should be informed about nutritional values, and impact of diet/food choice patterns can have on health.

1.2 phytochemicals table

plant made non-nutrients that may have health benefits.

Biological Effects/Possible Health		
Classification and Examples	Benefits	Rich Food Sources
Carotenoids Alpha-carotene, beta-carotene, lutein, lycopene, zeaxanthin	May reduce risk of certain cancers and macular degeneration (a major cause of blindness in the United States)	Orange, red, yellow fruits and vegetables; egg yolks
Phenolics	Antioxidant activity; may inhibit cancer growth and reduce risk of heart disease	
Quercetin		Apples, tea, red wine, onions, olives, raspberries, cocoa
Catechins		Green and black tea, chocolate, plums, apples, berries, pecans
Anthocyanins		Red, blue, or purple fruits and vegetables
Resveratrol		Red wine, purple grapes and grape juice, dark chocolate, cocoa
Isoflavonoids		Soybeans and other legumes
Tannins		Tea, coffee, chocolate, blueberries, grapes, persimmons
Monterpenes		Oranges, lemons, grapefruit, cherries
Organosulfides Isothiocyanates, indoles, allylic sulfur compounds	Antioxidant effects; may improve immune system functioning and reduce the risk of heart disease	Garlic, onions, leeks, cruciferous vegetables (broccoli, cauliflower, cabbage, kale, bok choy, collard and mustard greens)
Alkaloids Caffeine	Stimulant effects	Coffee, tea, "energy drinks," kola nuts, cocoa
Capsaicinoids Capsaicin	May provide some pain relief	Chili peppers

1.5 factors that influence eating

- biological and physiological factors: life stage
 - young children get pre selected foods from caregivers
 - young adults typically branch out as they leave home
 - older adults may have health conditions that require changes in food choices
- cognitive and psychological factors: learning processes
 - past experiences
 - cultural practices
 - religious teachings
 - stress level and mood
- environmental factors
 - proximity to store/food/cooking
 - government policies, food distribution, food marketing

1.6 concepts 3,4,6

concept 3

focusing your diet on primarily minimally-processed foods is best when possible, as processing can remove some beneficial nutrients and phytochemicals.

Some people have conditions that require them to take supplements to get the needed amounts of nutrients. Note: supplements do not need to be tested before being marketed, and are not regulated as strictly as medications by the FDA.

each nutrient has a safe intake range (physiological dose = ideal). When taken in high levels, many vitamins behave like drugs and can produce unpleasant and even toxic side effects. Compared to vitamins, most minerals have a very narrow range of safe intake.

concept 4

nutrient consumption is not a cure all for health issues. It can help some things like nutrient deficiencies, but diet is only one of many factors that impact a person's long term health.

concept 6

Nutrition is a dynamic science that we are constantly learning more about, so recommendations from professionals may change over time.

ch 2 - know